

Assessing the Value of the SimPraxis™ Laparoscopic Cholecystectomy Trainer

Aldo Gamarra, MD, Nancy J. Hogle, MPH, Basem Azab, MD,
Scott W. Bloom, MD, Warren D. Widmann, MD

ABSTRACT

Background and Objectives: Our aim was to determine whether the SimPraxis™ Laparoscopic Cholecystectomy Trainer is an effective adjunct for training both junior and senior surgical residents.

Methods: During the 2009–2010 academic year, 20 of 27 surgical residents at our institution completed training with the SimPraxis Laparoscopic Cholecystectomy Trainer. These 20 residents took an identical 25-question pre- and posttest prepared in-house by a senior laparoscopic surgeon, based on the SimPraxis Laparoscopic Cholecystectomy program content. Included within the SimPraxis program is a multiple data point scoring system. For our reporting purposes, we divided the residents into 2 groups, junior (PGY 1-2; n=11) and senior (PGY 3-5; n=9).

Results: The junior residents demonstrated a statistically significant improvement in their post-test scores ($P=.001$). On the contrary, the senior residents showed nonstatistically significant minor improvement in their examination scores ($P=.09$). While, the pretest scores were significantly higher for the senior residents compared with the junior residents ($P=.003$), the post-test scores were non-significantly different between the senior vs. the junior residents ($P=.07$). There was no significant difference between the time it took junior and senior residents to complete the SimPraxis program.

Conclusion: Our data demonstrate that junior residents benefitted the most from the SimPraxis training program.

Requiring junior surgical residents to complete both skills and cognitive training programs may be an effective adjunct in preparation for participation in laparoscopic cholecystectomy procedures.

Key Words: Laparoscopic education, Patient care, Interpersonal communication skills, Systems based practice.

INTRODUCTION

With the evolution of surgical training and the restrictions of duty hours, surgical residents spend less time in the hospital doing hands-on training. Therefore, it has become increasingly challenging for surgical programs to effectively train residents with the appropriate operative, bedside, and office/clinic experience given the current work hour restrictions.¹

Paradoxically, with the advent of high-resolution, high-definition monitors, cameras, and simulators, surgical training need no longer be limited to the operative theater. The opportunity to refine hand-and-eye coordination and laparoscopic skill enables residency programs to safely train residents in a simulated environment. At this time, it is no longer acceptable to the public and the accrediting agencies for residents to learn initial laparoscopic skills on patients.^{2–7}

Most simulators have been developed focused solely on improving basic skills required to perform laparoscopic procedures. One such trainer is the MISTELS (McGill Inanimate System for Training and Evaluation of Laparoscopic Skills). The MISTELS is a bench-model trainer that consists of 5 tasks performed in a box. Performance is scored on speed and precision. This mode of surgical skills training has been accepted for assessment and training of laparoscopic skills.^{2,8–13} MISTELS has been validated and refined to become the skills testing portion of the Fundamentals of Laparoscopic Surgery (FLS). The bridge from simulation to appropriate laparoscopic skill set to perform a laparoscopic cholecystectomy has become a topic of much debate.

Department of Surgery, Staten Island University Hospital, Staten Island, New York, USA (Drs. Gamarra, Azab, Bloom).

Department of Surgery, Columbia University College of Physicians and Surgeons, New York, New York, USA (Ms Hogle, Dr Widmann).

Department of Surgery, State University of New York, Downstate Medical Center, Brooklyn, New York, USA (Drs. Bloom, Widmann).

Presented at the meeting of the Association of Program Directors in Surgery, Boston, Massachusetts, March 2011.

Address correspondence to: Nancy Hogle, MPH, Department of Surgery, Columbia University College of Physicians and Surgeons, 177 Fort Washington Avenue, 7 South Knuckle, Room 010, New York, NY 10032, USA. Telephone: (212) 305-4713, E-mail: Nancyhogle@gmail.com

DOI: 10.4293/108680812X13291597717185

© 2012 by JSLS, Journal of the Society of Laparoendoscopic Surgeons. Published by the Society of Laparoendoscopic Surgeons, Inc.

When laparoscopic cholecystectomy was first performed in the late 1980s, multiple brief animal training courses were available. Later, laparoscopic cholecystectomy became integrated into the residency-training program, and these courses were no longer needed. Without any initial evidence-based studies, laparoscopic cholecystectomy rapidly became the standard approach, because of the perceived benefits of the marked reduction in patient pain and a much shorter patient hospital stay. However, despite a period of time for adequate training of practicing surgeons and resident surgeons, the bile duct injury complication rate for laparoscopic cholecystectomy remains 0.4% to 0.6% vs. 0.2% for the traditional open surgical approach.^{14–16} Additionally, there still are other complications of the laparoscopic approach that were not present with the open approach (eg, trocar injuries, wound hernias, “lost” stones). Traditionally, residents were judged ready to perform cholecystectomy by their demonstrated medical knowledge on questioning, with the assumption of surgical skill correlating with cognitive knowledge and accumulated experience with open surgical cases. The SimPraxis Laparoscopic Cholecystectomy Trainer is a simulation software platform for cognitive learning (URL: <http://www.redllamainc.com/>). The program runs on a personal computer. It is an interactive tool for learning the basic fundamentals of performing laparoscopic cholecystectomy, and unlike other programs, it is not focused on technical skills. The SimPraxis simulator takes the learner through every aspect of performing a laparoscopic cholecystectomy beginning with patient, surgeon, and assistants positioning to the removal of trocars and wound closure. The program has defined phases of the procedure that must be mastered prior to advancing to the next phase. The learner must pass a quiz before proceeding to the next phase. The learner is also quizzed on anatomy and familiarity with the required surgical instruments and their use. The learner is ultimately required to perform moves in the correct anatomic direction and is penalized for every wrong maneuver. An overall score at the end of the program assesses the skill and knowledge of the learner. The SimPraxis software while having quizzes does not measure performance improvement; it just measures performance. Hence, we created our own quiz to assess improvement.

Our aim was to determine whether the SimPraxis Laparoscopic Cholecystectomy Trainer was an effective adjunct for training both junior (PGY 1-2) and senior (PGY 3-5) surgical residents.

METHODS

During the 2009–2010 academic year, we included all 15 of our categorical and 5 preliminary residents for a total of 20 residents in this study. For reporting purposes, we divided the residents into 2 groups, junior (PGY 1-2; n=11) and senior (PGY 3-5; n=9). Included within the SimPraxis program is a multiple data point scoring system. A single performance score is reported at the completion of the program. The time (hours/min) required for completion of the program was also recorded for each resident.

We used our own measuring tool in the form of presimulation and postsimulation quizzes to assess the related subject knowledge of the residents. The presimulation and postsimulation quizzes (25 questions each) were identical but were taken months apart, during which time the residents completed the SimPraxis program. The quiz was developed by a senior laparoscopic surgeon and based on the SimPraxis program learning objectives, specifically the anatomy, instrument familiarity, and complications of the procedure. Both the pre- and postsimulation quiz scores were positively correlated with the SimPraxis program multiple data point scoring system ($r=0.43727$ and 0.35211 , respectively). Additionally, a year following completion of the training, a survey questionnaire consisting of 4 questions was given to all residents who had completed the SimPraxis Laparoscopic Cholecystectomy Trainer (n=20) to determine if they thought the program was beneficial.

Analysis

Paired 2-tailed, *t* test analysis was used to compare the results of the pre- and posttest before and after completion of the SimPraxis program. Unpaired 2-tailed *t* test analysis was used to compare the statistical significance between junior and senior residents in their pre- and posttest SimPraxis program scores. Junior pre- and posttest scores were also analyzed using the paired *t* test analysis. Two junior residents were disqualified from the data, because they were unable to complete the posttest or the SimPraxis program.

RESULTS

The junior residents demonstrated a significant improvement in their posttest scores ($P=.001$) as shown in **Figure 1**. On the contrary, the senior residents showed a trend of minor improvement in their examination scores ($P=.09$), as shown in **Figure 2**. While, the pretest scores were significantly higher for the senior residents in comparison

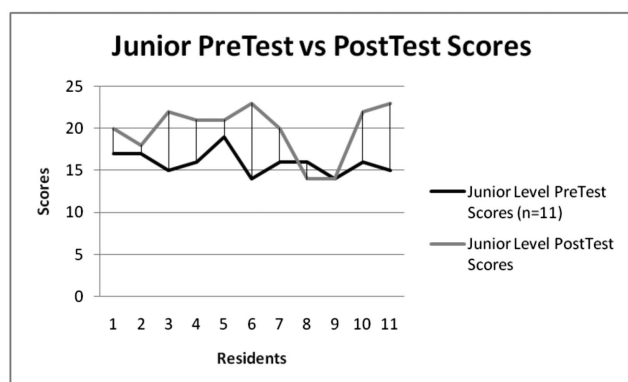


Figure 1. Comparison of junior residents' pre- and posttest scores ($P=.001$).

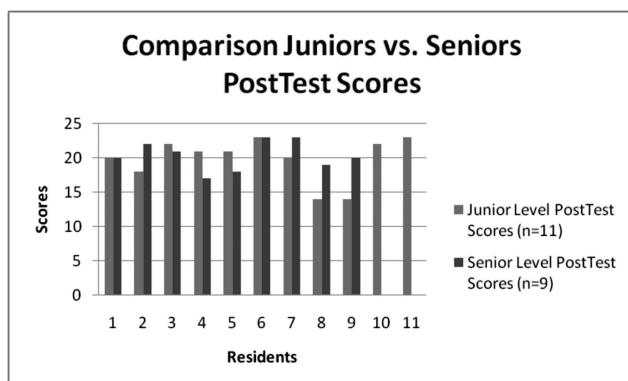


Figure 2. Comparison of junior and senior resident's posttest scores ($P=.07$).

to the junior residents ($P=.003$), the posttest scores were nonsignificantly different between the senior vs. the junior residents ($P=.07$). The senior residents had significantly higher SimPraxis Laparoscopic Cholecystectomy Program Scores ($P=.003$) as seen in **Figure 3**. This meant that senior residents had a definite advantage in knowing the anatomy, instruments to use, and had fewer overall errors than junior residents had. There was no significant difference between the time it took junior and senior residents to complete the SimPraxis program. Based on a survey created for and by the residents, 94% of residents reported that using the SimPraxis program was a positive experience and that they would recommend its incorporation into the curriculum. Additionally, 63% believed that it should be a prerequisite for residents before they are allowed to assist in the performance of a laparoscopic ch.

DISCUSSION

In our single institution residency program, we found that the SimPraxis program was quite useful for training junior

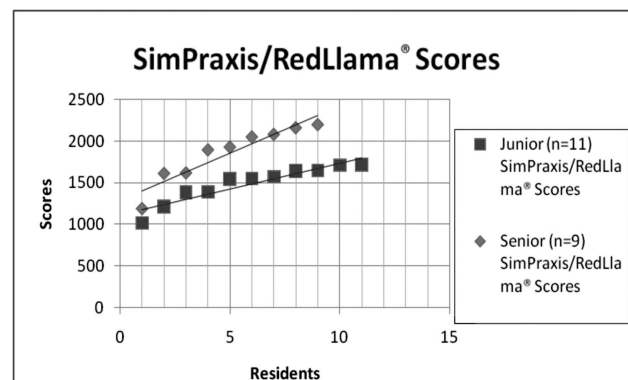


Figure 3. Difference in SimPraxis scores between junior and senior residents ($P=.003$).

residents as judged by our pre- and posttest examination scores, and verified by our opinion survey. We found marginal benefit for the senior residents who were already experienced in assisting at and performing laparoscopic cholecystectomy. Ideally, we would like to measure the success of the SimPraxis program in the operating room, which will need further long-term follow-up of the OR surgical performance of these trained junior residents in comparison to those were not exposed to similar training. We anticipate that obtaining sufficient numbers of patients consenting for this follow-up study would be difficult.

With the advent of "box trainers" and other simulation systems for acquisition of technical skill, and teaching programs such as the SimPraxis program for cognitive skills, we can better train our residents outside the operating room. We believe that trainees will have gained a better understanding of the anatomy, techniques, and most importantly the consequences of error in performing laparoscopic cholecystectomies before entering the operating room by the use of the SimPraxis program.

Limitations of our study include the small sample size, the single institutional nature of the study, and most importantly, the lack of "predictive value" demonstrated, namely whether all of the training resulted in better patient outcomes.

CONCLUSION

Based on the data collected from our own pre- and posttest scores, junior residents benefitted the most from the SimPraxis training program. Accordingly, we suggest that requiring junior surgical residents to complete both skills and cognitive training programs may be an effective means for preparation of surgical residents for participa-

tion in assisting and performing laparoscopic cholecystectomy. For senior residents (who are experienced in the performance of laparoscopic cholecystectomy), the SimPraxis training program may not be of sufficient benefit to justify the time required to complete the program.

References:

1. Powell AC, Nelson JS, Massarweh NN, Brewster LP, Santry HP. The modern surgical lifestyle. *Bull Am Coll Surg*. 2009;94(6):31–37.
2. Derossis AM, Fried GM, Abrahamowicz M, Sigman HH, Barkun JS, Meakins JL. Development of a model for training and evaluation of laparoscopic skills. *Am J Surg*. 1998;175(6):482–487.
3. Mori T, Hatano N, Maruyama S, Atomi Y. Significance of “hands-on training” in laparoscopic surgery. *Surg Endosc*. 1998;12(3):256–260.
4. Rosser JC, Rosser LE, Savalgi RS. Skill acquisition and assessment for laparoscopic surgery. *Arch Surg*. 1997;132(2):200–204.
5. Scott-Conner CE, Hall TJ, Anglin BL, et al. The integration of laparoscopy into a surgical residency and implications for the training environment. *Surg Endosc*. 1994;8(9):1054–1057.
6. Shapiro SJ, Paz-Partlow M, Kaykhovsky L, Gordon LA. The use of a modular skills center for the maintenance of laparoscopic skills. *Surg Endosc*. 1996;10(8):816–819.
7. Sigman HH, Fried GM, Hinchey EJ, et al. Role of the teaching hospital in the development of a laparoscopic cholecystectomy program. *Can J Surg*. 1992;35(1):49–54.
8. Feldman LS, Sherman V, Fried GM. Using simulators to assess laparoscopic competence: ready for widespread use? *Surgery*. 2004;135(1):28–42.
9. Mandel LP, Lentz GM, Goff BA. Teaching and evaluating surgical skills. *Obstet Gynecol*. 2000;95(5):783–785.
10. Issenberg SB, McGaghie WC, Hart IR, et al. Simulation technology for health care professional skills training and assessment. *JAMA*. 1999;282(9):861–866.
11. Fried GM. Simulators for laparoscopic surgery: a coming of age. *Asian J Surg*. 2004;27(1):1–3.
12. Fried GM, Derossis AM, Bothwell J, Sigman HH. Comparison of laparoscopic performance in vivo with performance measured in a laparoscopic simulator. *Surg Endosc*. 1999;13(11):1077–1081;discussion 1082.
13. Fraser SA, Klaassen DR, Feldman LS, Ghitulescu GA, Stanbridge D, Fried GM. Evaluating laparoscopic skills: setting the pass/fail score for the MISTELS system. *Surg Endosc*. 2003;17(6):964–967.
14. Ahrendt SA, Pitt HA. Surgical therapy of iatrogenic lesions of biliary tract. *World J Surg*. 2001;25(10):1360–1365.
15. Schmidt SC, Langrehr JM, Hintze RE, Neuhaus P. Long-term results and risk factors influencing outcome of major bile duct injuries following cholecystectomy. *Br J Surg*. 2005;92(1):76–82.
16. Tania O, Jain M, Khanna S, Sen B. Iatrogenic biliary injury: 13,305 cholecystectomies experienced by a single surgical team over more than 13 years. *Surg Endosc*. 2008;22(4):1077–1086; Epub Jan 18.